

## Synopsis of Direct and Indirect Digital Radiography Systems (Project 05-03)

A synopsis table listing specifications for many currently available DIRECT digital x-ray systems can be at the end of this article.

### **Synopsis Table: DIRECT Digital Radiography Systems**

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### **Synopsis Table: INDIRECT Digital Radiography Systems**

**NOTE FOR AIR FORCE USERS:** The Air Force Dental Service, through the Dental Operations Panel, has chartered an Air Force Dental Technology Board (AFDenT) to address USAF dental digital radiography issues. All dental digital radiography procurement requests must be forwarded to the clinic's MAJCOM AFDenT Board representative and approved by the AFDenT prior to being submitted for purchase. Contact your MAJCOM/SGD for your representative's name.

Digital radiography systems may be grouped into two main image acquisition categories: direct systems and indirect systems. Direct digital systems acquire images with a solid-state sensor that is connected to a computer (with a wire or wirelessly) to produce an image almost instantaneously following exposure. The other category of digital radiography, indirect digital systems, includes products utilizing photostimulable phosphor plates (PSP). Phosphor plates have a similar size and thickness to conventional film. Following intraoral placement and exposure, a phosphor plate is placed in a scanner that converts the image "stored" on the plate into a digital image. The plate is then "erased" by exposing it to a bright light prior to reusing it for further image acquisitions. There are advantages and disadvantages to both systems.

### **Direct systems**

The primary advantage of direct sensor systems is the speed with which images are acquired. The sensor is connected either by a wire or wirelessly to an analog-to-digital converter box (or card), which is connected to the computer. Images are produced within seconds of sensor exposure. Most of the current sensors utilize cords (rather than wireless) and this, along with sensor thickness, may make placement more difficult than conventional film or phosphor plates. However, proper positioning techniques may minimize this disadvantage for most views.

(Position the sensor further away from the teeth, more toward the center of the mouth.) Providers are reporting significant difficulty in obtaining *vertical* bitewing radiographs with corded sensors. Pediatric practices may have problems if younger children "chew" on the cord. Cost is another consideration. At several thousand dollars per sensor, sensors will likely be shared between operatories rather than purchasing one or two sensors for each operatory.



**Direct sensors**

The wire leading from a direct sensor varies in length by manufacturer, commonly being two to three meters long. This wire plugs into an analog-to-digital converter box or card. Some converter boxes connect to the computer with a USB cable. Others have an Ethernet jack for connection to a network. Some manufacturers offer both types of boxes. The analog-to-digital converter box varies in size by manufacturer. Some are small enough to secure to the arm of an x-ray unit. Others are large enough that they either sit on a counter or are wall mounted. The planned location for your converter box will affect the needed cord length on the sensor itself. The total cable length from the sensor to the computer will be the



**System examples showing a variety of USB and Ethernet boxes and a PCMCIA card**

length of the sensor cable plus the length of either the USB or Ethernet cable. Some systems utilize a PCMCIA card for analog-to-digital conversion rather than a "box." This card plugs directly into the computer, so in this case the cord on the sensor itself will need to be long enough to reach from the patient to the computer. When calculating the cost of additional sensors, remember to include the cost of additional converter boxes. If sharing sensors between operators, you can either purchase enough converter boxes to have one in every operator or leave the sensor plugged into the converter box and share the sensor/converter box as a unit. At least one company's Ethernet box has inputs for two sensor control boxes and could potentially be shared between two operators.

Direct digital panoramic and cephalometric units may also be purchased, or some conventional film models can be upgraded from a conventional model to a direct digital model. Once a panoramic unit has been outfitted with direct sensors it can no longer be used with conventional films (without physically converting it back to a conventional unit).

### **Indirect systems**

As with direct systems, there are advantages and disadvantages to indirect systems. The smaller size and lack of a cord may make intraoral placement of phosphor plates easier than placement of direct sensors. Phosphor plates are somewhat flexible, but the corners



**Phosphor plates and barriers**

cannot be bent (as is sometimes done with film) without damaging the plates. Phosphor plates can potentially be reused hundreds of times, but are susceptible to scratching which will shorten their useful life. Phosphor plates are light sensitive and exposure to ambient light must be minimized during the time period between removal from their protective cover and placement into the scanner. The length of time that plates are exposed to ambient light during this transfer process will determine the level of allowable ambient light at the scanner location. Scanners in which plates are loaded directly into a slot can generally be used in areas of higher ambient light compared to systems in which the plates are loaded on drums prior to placement in the scanner.



**Phosphor plate scanners**

plate is less than twenty-five dollars compared to several thousand dollars for each direct sensor. Most existing panoramic and cephalometric units do not require expensive upgrades for use with phosphor plates. Phosphor plates are simply placed in cassettes similar to film, except that no intensifying screens are used. Therefore, the same panoramic or cephalometric unit can be used to expose either conventional film or phosphor plates. Phosphor plate systems require purchase of a scanner. Large clinics may want to purchase two or more scanners to distribute throughout the clinic.

The primary disadvantage of phosphor plate systems involves the time required to scan and erase the plates. Following exposure, plates must be removed from their contaminated barrier pouches, run through the scanner, "erased" with bright light, and repackaged in clean barrier pouches prior to using again. For plate erasure, some scanners incorporate an "erase" cycle within the scanner itself. With other units the plates are moved to a separate plate eraser following the scanning process.

It is less expensive to purchase enough phosphor plates to place in every operatory compared to purchasing enough direct sensors for every operatory. The cost for an intraoral phosphor



**Phosphor plate eraser**

### Imaging area dimensions

Size 0: 22 x 35 mm
Size 1: 24 x 40 mm
Size 2: 31 x 41 mm
Size 3: 27 x 54 mm
Size 4: 57 x 76 mm

The imaging area of direct sensors and phosphor plates listed in the synopsis tables can be compared to the imaging area of conventional dental film. Listed here are conventional film sizes for comparison purposes.

### Imaging software

Prior to the development of DICOM (Digital Imaging and Communications in Medicine) standards, most manufacturers utilized proprietary image file formats that were not compatible with other manufacturers' systems. However, more and more dental imaging systems are becoming DICOM compliant. DICOM compliant systems can share image files. This makes it easier to transfer saved images from one manufacturer's system to another. While this improves the transfer of saved images, most manufacturers' imaging software still will only acquire images using that same manufacturer's sensors. In other words, with most systems, if a large clinic happened to own ten of company A's direct sensors, company B's direct pano unit, and was considering the purchase of two new sensors from company C, they could not use company A's imaging software to directly acquire images from company B's pano and company C's sensors. However, there are some "open platform" imaging software programs that can acquire digital

radiography images using multiple manufacturers' image acquisition hardware (intraoral and pano/ceph direct sensors and phosphor plate systems). These programs are usually purchased separately from hardware purchases. In addition to radiography images, these programs also typically integrate digital images from other sources including intraoral and digital cameras. Using open platform software allows a clinic to choose from multiple available sensors, pano/ceph units, phosphor plate systems, and intraoral and digital cameras. Purchasing a sensor from one manufacturer would not lock the clinic into purchasing all sensors from that same manufacturer in the future. In large organizations such as the military, if all clinics utilize the same open platform imaging software, there is a consistent user interface from clinic to clinic, even though there may be some variability in the imaging hardware used. Always confirm compatibility of your desired hardware prior to purchasing open platform imaging software.

Any software installed on an Air Force networked computer must be taken through a formal certification and accreditation procedure prior to installation. This can be a lengthy process if the software has not been previously certified. Clinic personnel must coordinate software installations with information systems staff to ensure this requirement is met.

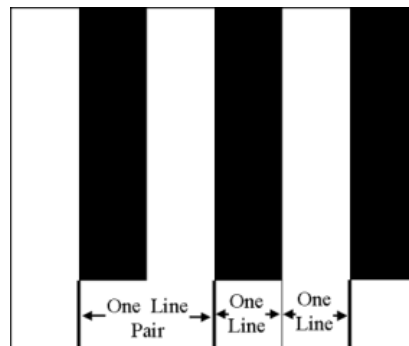
### **Spatial and contrast resolution**

Spatial resolution and contrast resolution are two specifications often mentioned by digital product manufacturers.

#### *Spatial resolution*

Spatial resolution is generally stated in line pairs per mm (lp/mm).

A line is a black or white "bar". A line pair is a set of one black and one white "bar." Resolution in line pairs per millimeter represents how many of these alternating black and white line pairs can be distinguished in a one-millimeter width. The naked eye can generally perceive between 8-10 lp/mm. Most digital sensors fall in the range of 8-15 lp/mm, which provides very satisfactory resolution for viewing dental structures. There may be a small benefit to slightly higher resolutions than this when magnification is used, but as resolution continues to increase, there comes a point where the additional resolution no longer provides more information on the object being viewed. The



maximum "usable" resolution for any given object depends on the size of the object being viewed. There is an upper limit to the resolution "needed" to view dentin, enamel, alveolar bone, endodontic files, etc. Care must be taken when interpreting manufacturer resolution claims. Some manufacturers quote theoretical resolution, some quote actual (measured) resolution, and frequently there is no statement as to whether the numbers quoted are theoretical or actual values. Theoretical resolution represents the maximum theoretical resolution based on pixel size and is always greater than the actual, or measurable resolution. A pixel, or picture element, may be thought of as one of the thousands of tiny dots that make up an image. Digital sensors are composed of an array of thousands of tiny electron wells. Each of these wells typically represents one pixel in the final image. Smaller and more tightly packed wells, and thus pixels, generally result in increased resolution, but other construction factors will also affect resolution. Also, some manufacturers will use 2x2 pixel binning which effectively combines 4 small pixels (for example 19 or 20 micron) into one larger pixel (ex: 38 or 40 micron) for image production purposes.

#### *Contrast resolution*

Each pixel in an image can present as a shade of gray. Contrast resolution refers to the dynamic range, or number of grays available. This may be stated as the actual number of grays, such as 4096, or it may be stated as bit depth, such as 12 bits. Bit depth progresses in powers of 2.



1 bit	$2^1 = 2$ shades of gray (black and white)
2 bits	$2^2 = 2 \times 2 = 4$ shades of gray
3 bits	$2^3 = 2 \times 2 \times 2 = 8$ shades of gray
8 bits	$2^8 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 256$ shades of gray
12 bits	$2^{12} = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 4096$ shades of gray
16 bits	$2^{16} = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 65,536$ shades of gray

Many sensors capture 12 bit images (4096 grays), some sensors capture 16 bit images (65,536 grays). Most computer monitors can only display 8 bit grayscale images (256 grays) and the human eye can typically only differentiate between 32-64 grays. If an image contains data for additional grays above what the monitor can display, the additional data may be of some benefit if the imaging software is capable of a digital processing method called windowing. Windowing is the process of selecting a certain segment of the total range of grays captured, then displaying that segment on the monitor over the full grayscale range from white to black. Windowing gives the ability to focus in on specific segments of the large number of grays captured by 12 and 16 bit sensors. While this ability may provide some advantages, current research has not supported the concept that increasingly greater bit depths improve diagnostic ability. 8 bit data provides very satisfactory images and diminishing returns are obtained from bit depths greater than this.

### Infection Control Issues

The *USAF Guidelines for Infection Control in Dentistry* and the CDC's *Guidelines for Infection Control in Dental Health-Care Settings - 2003* offer similar guidance regarding the use of digital sensors. Quoting from the USAF Guidelines, sensors are categorized as semi-critical items and they:

"...should be cleaned and ideally should be heat-sterilized or high-level disinfected between patients. However, these items vary by manufacturer or type of device in their ability to be sterilized or high-level disinfected. The following apply for digital radiography sensors:


- a. Use FDA-cleared barriers.
- b. To minimize the potential for device-associated infections, after removing the barrier, clean and disinfect using an EPA-registered hospital disinfectant with an intermediate-level activity after each patient."

Because sensors and associated components vary by manufacturer and are expensive, manufacturers should be consulted regarding specific disinfection products and procedures. Some manufacturers recommend against using certain chemicals on their sensors. Also, some manufacturers allow immersion of their sensors while others do not.

### Other considerations

Other considerations when selecting a digital radiography system include company service/support, system cost, length of warranty, and ease of use/capability of imaging software. Compatibility with open platform imaging software will be a consideration for those clinics utilizing these software packages. Adequate cable length and sensor size/shape is another consideration. Sensors with rounded edges may be more comfortable. Sensor wires exiting from the back of the sensor may make for easier placement in some situations compared to configurations where the wire exits from the end of the sensor. Sensor thickness disadvantages may be minimized when sensors are positioned properly (more toward the center of the mouth). Multiple considerations come into play when selecting a digital radiography package and there are advantages and disadvantages to all systems.

## Direct Dental Digital Radiography Systems (CCD, CMOS)<sup>USAF DECS</sup>

<b>Model</b>	<b>Dent-X EVA</b> 	<b>DEXIS Digital X-ray System</b> 	<b>GE Healthcare Sigma</b> 
<b>Company</b>	Dent-X Corporation USA 250 Clearbrook Road Elmsford, NY 10523 (800) 225-1702	Dexis 2550 Northwinds Parkway Suite 100 Alpharetta, GA 30004 (888) 883-3947	GE Healthcare 300 West Edgerton Avenue Milwaukee, WI 53207-6025 (800) 558-6120
<b>Web link</b>	<a href="http://www.dent-x.com">www.dent-x.com</a>	<a href="http://www.dexray.com">www.dexray.com</a>	<a href="http://www.gehealthcare.com">www.gehealthcare.com</a>
<b>Gov't point of contact</b>	Adam Rabinovitch (914) 592-6100 ext 210 arabinovitch@dent-x.com	Kim Mercer (888) 883-3947 ext 253 kim@dexray.com	Mike Null (414) 747-6352 mike.null@med.ge.com
<b>Components in package<sup>1</sup></b>	Sensor - choice of size 1 or 2 USB box Imaging software (Site license) Positioning kit	Sensor - universal size PCMCIA capture card Imaging software (Single user license) Positioning kit	Sensor - see pkgs below USB box Imaging software (5 user licenses) Positioning kit
<b>Cost of package</b>	Retail/gov't \$8,200/\$6,295	Retail/gov't \$11,000/\$9,000	Retail/gov't Size #1: \$10,375/\$6,336 Size #2: \$11,800/\$7,207
<b>Cost of additional sensors</b>	Retail/gov't (Includes ADC <sup>3</sup> which is attached to sensor cord) Size 1: \$7,500/\$6095 Size 2: \$7,500/\$6095	Retail/gov't (Includes ADC <sup>3</sup> capture card) Universal size: \$9,000/\$7,000	Retail/gov't (Sensor only) Size 1: \$7,272/\$4,442 Size 2: \$8,587/\$5,245
<b>Other equipment costs</b>	Retail/gov't USB docking station: \$300/\$200	Retail/gov't USB adaptor for capture card: \$499/\$499	Retail/gov't USB box (houses ADC <sup>3</sup> ): \$2680/\$1637
<b>Sensor warranty<sup>2</sup></b>	3 years	1 year	2 years
<b>Sensor type</b>	CMOS	CCD	CCD
<b>Sensor external dimensions</b>	Size 1: 25.6 x 38.4 x 4.8 mm Size 2: 30.8 x 44.1 x 4.8 mm	Universal: 29.3 x 38.7 x 9.0 mm	Size 1: 24 x 36 x 6.8 mm Size 2: 30 x 40 x 6.8 mm
<b>Sensor imaging area dimensions</b>	Size 1: 20 x 30 mm Size 2: 25.8 x 36 mm	Universal: 25.6 x 32 mm	Size 1: 20 x 32 mm Size 2: 26 x 34 mm
<b>Pixel size</b>	30 micron	40 micron	19.5 micron
<b>Dynamic range</b>	12 bit	12 bit	12 bit
<b>Sensor cable length</b>	2 meter	2.44 meter with 1.22 meter extension available	3 meters
<b>Computer interface options</b>	USB	PCMCIA card USB adaptor for PCMCIA card available	USB

Manufacturers provided data for table

<sup>1</sup>Primary items in package are listed. Other items such as cables and hygienic covers may be included. Check with manufacturer for software licensing details. Other package configurations may be available from manufacturer.

<sup>2</sup>Check with manufacturer for warranty details.

<sup>3</sup>ADC = Analog-to-digital converter.






<b>Model</b>	<b>Gendex GX-S Visualix HDI</b> 	<b>Kodak RVG 6000</b> 	USAF DECS <b>Lightyear</b> 
	<b>Company</b> Gendex Dental Systems 340 E. Main Street Lake Zurich, IL 60047 (888) 275-5286	<b>Company</b> Kodak Dental Systems 1765 The Exchange Atlanta, GA 30339 1-800-944-6365	<b>Company</b> Lightyear Technology, Inc. 85-C Mill Street, Suite 100 Roswell, GA 30075 (866) 946-2431
<b>Web link</b>	<a href="http://www.gendex.com">www.gendex.com</a>	<a href="http://www.kodak.com/go/dental">www.kodak.com/go/dental</a>	<a href="http://www.lightyeartechology.com">www.lightyeartechology.com</a>
<b>Gov't point of contact</b>	Call Gendex to obtain regional rep: (888) 275-5286	William Altvater 800-262-8144 x7277 william.altvater@kodak.com	George Hummert (866) 946-2431 Ext. 107 ghummert@lightyeartechology.com
<b>Components in package<sup>1</sup></b>	Sensor - size #2 USB box Imaging software (Site license) Positioning kit	Sensor - see pkgs below Imaging software (Site license) Positioning kit	Sensor - size #2 USB box Imaging software (Single user license) Positioning kit
<b>Cost of package</b>	Retail/gov't \$10,050/\$6,166	Retail/gov't Size 1: \$12,895/\$7,737 Size 2: 13,985/\$8,337	Retail/gov't \$11,995/\$8,996
<b>Cost of additional sensors</b>	Retail/gov't (Sensor only) Size 1: \$6,690/\$3,206 Size 2: \$7,775/\$3,991	Retail/gov't (Includes ADC <sup>3</sup> which is attached to sensor cord) Size 1: \$9,250/\$5,550 Size 2: \$9,995/\$5,997	Retail/gov't (Sensor only) Size 0: \$5,995/\$4,496 Size 1: \$5,995/\$4,496 Size 2: \$6,995/\$5,246
<b>Other equipment costs</b>	Retail/gov't USB box (houses ADC <sup>3</sup> ): \$2,165/\$1,297	Retail/gov't Separate USB box not required. Optional USB hub: \$100/\$60	Retail/gov't USB box (houses ADC <sup>3</sup> ): \$1,495/\$1,121
<b>Sensor warranty<sup>2</sup></b>	2 years	2 years	5 years
<b>Sensor type</b>	CCD	CMOS	CCD
<b>Sensor external dimensions</b>	Size 1: 25 x 39.5 x 5.7 mm Size 2: 32.5 x 42.5 x 5.6 mm	Size 1: 40 mm x 26 mm x 8 mm Size 2: 45 mm x 31 mm x 8 mm	Size 0: 26.4 x 32.5 x 3.2 mm Size 1: 24.7 x 37.8 x 3.2 mm Size 2: 31.8 x 43.0 x 3.2 mm
<b>Sensor imaging area dimensions</b>	Size 1: 20 x 30 mm Size 2: 28 x 36 mm	Size 1: 22 x 30 mm Size 2: 27 x 36 mm	Size 0: 21.6 x 26.8 mm Size 1: 20.6 x 32.7 mm Size 2: 26.6 x 36.8 mm
<b>Pixel size</b>	22 micron	18.5 micron	-----
<b>Dynamic range</b>	12 bit	12 bit	12 bit
<b>Sensor cable length</b>	3 meters	2.5 meter	3 meter
<b>Computer interface options</b>	USB	USB	USB

Manufacturers provided data for table

<sup>1</sup>Primary items in package are listed. Other items such as cables and hygienic covers may be included. Check with manufacturer for software licensing details. Other package configurations may be available from manufacturer.

<sup>2</sup>Check with manufacturer for warranty details.

<sup>3</sup>ADC = Analog-to-digital converter.

<b>Model</b>	<b>Mediadent MDX</b> 	<b>Planmeca Dixi 3<sup>4</sup></b> 	<b>Progeny MPSe</b> 
<b>Company</b>	Multimedia Dental Systems 1302 Macy Drive Roswell, GA 30076 (877) 770-8514	Planmeca USA 100 N. Gary Ave., Suite A Roselle, IL 60172 (630) 529-2300	Progeny Dental 1407 Barclay Boulevard Buffalo Grove, Illinois 60089 (888) 924-3800
<b>Web link</b>	<a href="http://www.mediadentusa.com">www.mediadentusa.com</a>	<a href="http://www.planmecausa.com">www.planmecausa.com</a>	<a href="http://www.progeny dental.com">www.progeny dental.com</a>
<b>Gov't point of contact</b>	Scott McLaughlin (770) 998-7386 scottm@mediadentusa.com	Michelle Bottino (630) 529-2300 ext 3015 michelle.bottino@planmecausa.com	Tony Bavuso (847) 850-3800 ext 239 abavuso@progeny dental.com
<b>Components in package<sup>1</sup></b>	Sensor - size #2 USB box Imaging software (5 user license) Positioning kit	Sensor - size #2 CCD Control box <sup>5</sup> Ethernet box Imaging software (Single user license) Positioning kit	Sensor(s) - see pkgs below Ethernet box Drivers for use with customer's existing imaging software Positioning kit
<b>Cost of package</b>	Retail/gov't \$8,790/\$6,500	Retail/gov't \$12,661/\$6,640	Retail/gov't Size #1: \$7535/\$4520 Size #2: \$8250/\$4950 Size #1 & 2: \$15,025/\$9015
<b>Cost of additional sensors</b>	Retail/gov't (Sensor only) Size 1: \$6,250/\$5,000 Size 2: \$7,125/\$5,700	Retail/gov't (Sensor only) Size 0: \$4,819/\$2,527 Size 1: \$7,168/\$3,759 Size 2: \$9,351/\$4,903	Retail/gov't (Sensor only) Size 1: \$6,295/\$3,777 Size 2: \$7,295/\$4,378
<b>Other equipment costs</b>	Retail/gov't USB box (houses ADC <sup>3</sup> ): \$1795/\$1436	Retail/gov't CCD control box (houses ADC <sup>3</sup> ): \$1,634/\$857 USB box or PCI card: \$2286/\$1198 Network interface box: \$2,547/\$1,335	Retail/gov't Ethernet box (houses ADC <sup>3</sup> ): \$1995/\$1197
<b>Sensor warranty<sup>2</sup></b>	3 years	2 years	2 years
<b>Sensor type</b>	CCD	CCD	CCD
<b>Sensor external dimensions</b>	Size 1: 25 x 39.5 x 5.7 mm Size 2: 32.5 x 45.5 x 5.6 mm	Size 0: 18 x 27 x 6 mm Size 1: 24 x 42 x 6 mm Size 2: 31 x 44 x 6 mm	Size 1: 25 x 39 x 5 mm Size 2: 32.5 x 42.5 x 5.6 mm
<b>Sensor imaging area dimensions</b>	Size 1: 20 x 30 mm Size 2: 27.5 x 36 mm	Size 0: 15 x 21 mm Size 1: 20 x 35 mm Size 2: 26 x 37 mm	Size 1: 20.1 x 30.1 mm Size 2: 27.5 x 36.1 mm
<b>Pixel size</b>	22 micron	19 micron	22 micron
<b>Dynamic range</b>	16 bit	12 bit	16 bit
<b>Sensor cable length</b>	2 meter	0.9 meter or 1.8 meter	2 meters
<b>Computer interface options</b>	USB	USB Ethernet PCI card	Ethernet (Ethernet to USB adaptor available)

Manufacturers provided data for table

<sup>1</sup>Primary items in package are listed. Other items such as cables and hygienic covers may be included. Check with manufacturer for software licensing details. Other package configurations may be available from manufacturer.


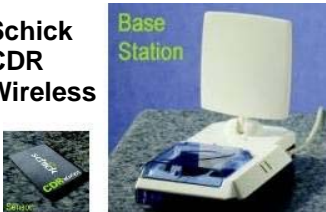

<sup>2</sup>Check with manufacturer for warranty details.

<sup>3</sup>ADC = Analog-to-digital converter.

<sup>4</sup>Size 0 Planmeca sensor is a DIXI2 sensor. Size 1 and 2 sensors are DIXI3 sensors.

<sup>5</sup>The Planmeca system requires use of a CCD control box (which contains the ADC) plus either an Ethernet box or USB box.



<b>Model</b>	<b>Schick CDR</b> 	<b>Schick CDR Wireless</b> 	<b>Sirona SIDEXIS</b> 
<b>Company</b>	Schick Technologies, Inc. 30-00 47th Avenue Long Island City, NY 11101 (718) 937-5765	Schick Technologies, Inc. 30-00 47th Avenue Long Island City, NY 11101 (718) 937-5765	Sirona Dental Systems LLC 4835 Sirona Drive, Suite 100 Charlotte, NC 28273 (800) 659-5977
<b>Web link</b>	<a href="http://www.schicktech.com">www.schicktech.com</a>	<a href="http://www.schicktech.com">www.schicktech.com</a>	<a href="http://www.sirona.com">www.sirona.com</a>
<b>Gov't point of contact</b>	Manny Pena (877) 724-4251 mpena@schicktech.com	Manny Pena (877) 724-4251 mpena@schicktech.com	Patricia Czaplinsky (800) 659-5977 ext 117 patricia.czaplinsky@sirona.com
<b>Components in package<sup>1</sup></b>	Sensor - size #2 USB box Imaging software (Single user license) Positioning kit	Sensor - #2 wireless Wireless receiver Imaging Software (Single user license) Positioning Kit	Sensor(s) - see pkgs below USB box Imaging software (Site license) Positioning kit
<b>Cost of package</b>	Retail/gov't \$12,037/\$6,418	Retail/gov't \$17,766/\$9,105	Retail/gov't Size #1: \$10,920/\$6,047 Size #2: \$11,750/\$6,509 Size #1 & 2: \$18,200 /\$10,050
<b>Cost of additional sensors</b>	Retail/gov't (Sensor only) Size 0: \$4,658/\$2,638 Size 1: \$7,108/\$3,894 Size 2: \$8,335/\$4,523	Retail/gov't (Sensor only) Size 1: \$10,663/\$5,465 Size 2: \$12,500/\$6,407	Retail/gov't (Sensor only) Size 1: \$6,759/\$3,866 Size 2: \$7,570/\$4,342
<b>Other equipment costs</b>	Retail/gov't USB box (houses ADC <sup>3</sup> ): \$1595/\$817	Retail/gov't Wireless receiver (houses ADC <sup>3</sup> ): \$3432/\$1759	Retail/gov't USB box (houses ADC <sup>3</sup> ): \$2,080/\$1,151 Ethernet box (houses ADC <sup>3</sup> ): \$2,599/\$1,439
<b>Sensor warranty<sup>2</sup></b>	1 year	1 year	2 years
<b>Sensor type</b>	CMOS	CMOS	CCD
<b>Sensor external dimensions (mm x mm x mm)</b>	Size 0: 22 x 31 x 5 mm Size 1: 24 x 37 x 5 mm Size 2: 30 x 43 x 5 mm	Size 1: 24 x 37 x 5 mm Size 2: 30 x 43 x 5 mm	Size 1 = 24 x 35.8 x 4.0 mm Size 2 = 30.1 x 40.2 x 5.0 mm
<b>Sensor imaging area dimensions (mm x mm)</b>	Size 0: 18 x 24 mm Size 1: 20 x 30 mm Size 2: 25.6 x 36 mm	Size 1: 20 x 30 mm Size 2: 25.6 x 36 mm	Size 1 = 20 x 30 mm Size 2 = 26 x 34 mm
<b>Pixel size</b>	40 micron	40 micron	19.5 micron
<b>Dynamic range</b>	12 bit	12 bit	12 bit
<b>Sensor cable length</b>	2 meter	NA	3 meters
<b>Computer interface options</b>	USB	USB	USB Ethernet

Manufacturers provided data for table

<sup>1</sup>Primary items in package are listed. Other items such as cables and hygienic covers may be included. Check with manufacturer for software licensing details. Other package configurations may be available from manufacturer.

<sup>2</sup>Check with manufacturer for warranty details.

<sup>3</sup>ADC = Analog-to-digital converter.

# Indirect Dental Digital Radiography Systems (Phosphor Plates)



USAF DECS

Model	Air Techniques ScanX 	Air Techniques ScanX Intraoral 	Gendex DenOptix 
Company	Air Techniques 70 Cantiague Rock Road P.O. Box 870 Hicksville, NY 11802 Ph: (800) 247-8324	Air Techniques 70 Cantiague Rock Road P.O. Box 870 Hicksville, NY 11802 Ph: (800) 247-8324	Gendex Dental Systems 340 E. Main Street Lake Zurich, IL 60047 (888) 275-5286
Web link	<a href="http://www.airtechniques.com">www.airtechniques.com</a>	<a href="http://www.airtechniques.com">www.airtechniques.com</a>	<a href="http://www.gendex.com">www.gendex.com</a>
Gov't point of contact	Eugene Heil (423) 753-9909 gheilgov@aol.com	Eugene Heil (423) 753-9909 gheilgov@aol.com	Call Gendex to obtain regional rep: (888) 275-5286
Components in basic package <sup>1</sup>	Scanner 4 each size 2 PSP guides 1 each size 0, 1, & 3 PSP guides 20 size 2 PSPs (imaging plates) 1 plate transfer box	Scanner 4 each size 2 PSP guides 1 each size 0, 1, & 3 PSP guides 20 size 2 PSPs (imaging plates) 1 plate transfer box	Scanner Phosphor plate carousel(s) Imaging software (Site license) Imaging plates (varies by pkg)
Cost of basic package	Retail/gov't \$19,995/\$12,597	Retail/gov't \$11,495/\$7,047	Retail/gov't Intraoral: \$14,111/\$8,018 Intraoral & pano: \$20,497/\$11,624 Intraoral, pano, ceph: \$22,145/call
Unit accepts listed plate sizes  Cost of additional plates	Retail/gov't Size 0: \$22.00/\$16.80 Size 1: \$22.00/\$16.80 Size 2: \$22.00/\$16.80 Size 3: \$22.00/\$16.80 Size 4: \$60.00/\$45.83 5"x12" pano: \$775/\$514 6"x12" pano: \$795/\$527 8"x10" ceph: \$850/\$564 Plate eraser \$875/\$536	Retail/gov't Size 0: \$22.00/\$16.80 Size 1: \$22.00/\$16.80 Size 2: \$22.00/\$16.80 Size 3: \$22.00/\$16.80 Size 4: \$60.00/\$45.83  Plate eraser \$875/\$536	Retail/gov't Size 0: \$21.00/\$17.00 Size 1: \$21.50/17.43 Size 2: \$22.50/16.13 Size 3: \$27.50/43.35 Size 4: \$65.00/51.85 5"x12" pano: \$875/543 6"x12" pano: \$885/575 8"x10" ceph: \$970/596
Scanner warranty <sup>2</sup>	2 years	2 years	2 years
Intraoral plate imaging area dimensions	Size 0: 22mm x 35mm Size 1: 24mm x 40mm Size 2: 31mm x 41mm Size 3: 27mm x 54mm	Size 0: 22mm x 35mm Size 1: 24mm x 40mm Size 2: 31mm x 41mm Size 3: 27mm x 54mm	Size 0: 22mm x 35mm Size 1: 24mm x 40mm Size 2: 31mm x 41mm Size 3: 27mm x 54mm
Scan time from plate insertion to image display	<i>Intraoral</i> : 17 sec for 1 <sup>st</sup> plate, then 4 sec each additional plate at standard resolution <i>Pano</i> : 25 sec at std resolution	<i>Intraoral</i> : 17 sec for 1st plate, then 4 sec each additional plate at standard resolution	<i>Intraoral</i> : 72seconds at standard resolution <i>Pano</i> : 180seconds at standard resolution
Method to erase plates	Separate plate eraser	Separate plate eraser	Separate plate eraser
Ambient lighting recommendations at scanner location	Less than 400 lux; designed for use in normal office lighting; avoid direct sunlight.	Less than 400 lux; designed for use in normal office lighting; avoid direct sunlight.	Low light (10-20 lux)
Scanner dimensions(HxWxD)	24" x 14" x 14"	15.5" x 15" x 15"	15.5" x 19.4" x 10.1"
Scanner electrical requirements	100-240V, 50/60 Hz	100-240V, 50/60 Hz	100-240V, 50/60 Hz
Scanner interface with computer	USB	USB	USB

Manufacturers provided data in table

<sup>1</sup>Primary items in package are listed. Other items such as cables and hygienic covers may be included. Check with manufacturer for software licensing details.

<sup>2</sup>Check with manufacturer for warranty details.

<b>Model</b>	<b>Soredex Digora PCT</b> 	<b>Soredex OpTime</b> 
<b>Company</b>	Soredex USA 300 West Edgerton Avenue Milwaukee, WI 53207-6025 (800) 558-6120	Soredex USA 300 West Edgerton Avenue Milwaukee, WI 53207-6025 (800) 558-6120
<b>Web link</b>	<a href="http://www.soredexusa.com">www.soredexusa.com</a>	<a href="http://www.soredexusa.com">www.soredexusa.com</a>
<b>Gov't point of contact</b>	Mike Null (414) 747-6352 mike.null@med.ge.com	Mike Null (414) 747-6352 mike.null@med.ge.com
<b>Components in basic package<sup>1</sup></b>	Scanner and stand Imaging software (5 user licenses) One 6x12 pano plate & sleeve	Scanner 20 size 2 plates Imaging software (5 user licenses)
<b>Cost of basic package</b>	Retail/gov't \$28,530/\$17,342	Retail/gov't \$11,395/\$7,749
<b>Unit accepts listed plate sizes</b>  <b>Cost of additional plates</b>	Retail/gov't 6"x12" pano: \$788/\$489 8"x10" ceph: \$735/\$456 10"x12" plate: \$855/531	Retail/gov't Size 0: \$22.00/\$14.96 Size 1: \$22.00/\$14.96 Size 2: \$22.00/\$14.96 Size 3: \$26.00/\$17.68
<b>Scanner warranty<sup>2</sup></b>	2 years	2 years
<b>Intraoral plate imaging area dimensions</b>	NA	Size 0: 22mm x 31mm Size 1: 24mm x 40mm Size 2: 31mm x 41mm Size 3: 27mm x 54mm
<b>Scan time from plate insertion to image display</b>	<i>Pano</i> : 75 seconds at standard resolution	<i>Intraoral</i> : 4.3- 7.5 seconds at standard resolution
<b>Method to erase plates</b>	Scanner erases plates	Scanner erases plates
<b>Ambient lighting recommendations at scanner location</b>	standard room lighting	standard room lighting
<b>Scanner dimensions(HxWxD)</b>	28.2" x 29.5" x 21.7"	7.5" x 8.7" x 15.5"
<b>Scanner electrical requirements</b>	100-240V, 50-60 Hz	100-240V, 50-60 Hz
<b>Scanner interface with computer</b>	Ethernet	Ethernet

Manufacturers provided data in table

<sup>1</sup>Primary items in package are listed. Other items such as cables and hygienic covers may be included. Check with manufacturer for software licensing details.

<sup>2</sup>Check with manufacturer for warranty details.